* NOTICES *

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to the tire / wheel assembly object which reduced the noise by cavernous resonance effectively in more detail about the tire / wheel assembly object which forms a closed space between a tire inside surface and a rim where a wheel is equipped with a tire.
[0002]
[Description of the Prior Art]The cavernous resonance phenomena generated in a closed space formed between a tire and a wheel are a factor with a major tire noise. For example, these cavernous resonance phenomena are participating in the crashing sound generated when overshooting during a run the noise which can be regularly heard near 250 Hz, its joint of a road, etc.
[0003]Adding a sound-absorbing material to the inside of a tire, and absorbing a resonance as the technique of reducing the noise by such cavernous resonance phenomena, is proposed. However, since this technique does not control generating of cavernous resonance fundamentally, in the sound-absorbing material with which it can equip actually in the inside of a tire, the reduction effect of noise was not fully able to be acquired.
[0004]
[Problem(s) to be Solved by the Invention]The purpose of this invention is to provide the tire / wheel assembly object which made it possible to reduce the noise by cavernous resonance effectively.
[0005]
[Means for Solving the Problem]The tire / wheel assembly object of this invention for attaining the above-mentioned purpose, In a tire-maximum-width field at least, arbitrary objects have been arranged to circumference top discontinuity, and it fixed to a closed space formed

between a tire and a wheel at either said tire and said wheel so that it might become non-contact to a sidewall inner surface of said tire.

[0006]Thus, by arranging objects arbitrary to a closed space formed between a tire and a wheel to circumference top discontinuity, generating of cavernous resonance phenomena in this closed space can be controlled, and noise by cavernous resonance can be reduced effectively.

[0007]In arranging said object to a closed space, in a tire-maximum-width field at least, it is required to consider it as non-contact to a sidewall inner surface of a tire. That is, although most greatly changed in a tire-maximum-width field during a run, if a sidewall part of a tire touches [an object built in a closed space] a sidewall inner surface in a tire-maximum-width field, since this will vibrate and a new noise emitting source will be served as, it is not preferred. Here, a tire-maximum-width field is 10% of field of tire section height centering on a tire maximum width position at the tire diameter direction outside and the inside, respectively.

[0008]As for an object built in a closed space, in order to improve a noise reduction effect in this invention, it is preferred to satisfy the following requirements.

[0009](1) An object consists of with an apparent relative density of 0.1 or less low-specific-gravity materials.

(2) Cross-section areas in an objective tire meridian line section are 5% - 40% of cross-section areas of a closed space.

[0010](3) Make the length of an objective tire hoop direction larger than height of a tire diameter direction.

(4) An object includes much air space and is in a range whose average radii of these air space are 0.1 mm - 3 mm.

(5) Provide unevenness on the surface of an object, and provide especially unevenness in the end face of an objective tire hoop direction.

[0011]In this invention, if an object built in a closed space is used as counterbalance for adjusting mass imbalance of a tire simple substance, it will become possible to utilize this object effectively not only in reduction of noise.

[0012]

[Embodiment of the Invention]Hereafter, it explains in detail, referring to an attached drawing for the composition of this invention.

[0013]Drawing 1 is a meridian line sectional view showing the tire / wheel assembly object which consists of an embodiment of this invention. Pneumatic tire T is provided with the sidewall part 3 which connects mutually the tread part 1, the bead part 2 of a right-and-left couple, and these tread parts 1 and the bead part 2 in drawing 1. On the other hand, the wheel W comprises the disk 12 which connects the rim 11 for equipping with the bead parts 2 and 2 of the tire T, and this rim 11 and an unillustrated axle. And when the wheel W is equipped with

the tire T, the closed space 4 is formed between the tire T and the wheel W.

[0014]In this closed space 4, in the tire-maximum-width field at least, the object 5 is arranged so that it may become non-contact to the sidewall inner surface of the tire T. That is, the object 5 is non-contact to a sidewall inner surface in the strip region which has 10% of width of tire section height h in the tire diameter direction outside and the inside focusing on tire maximum width position m, respectively. As shown in drawing 4, this object 5 is discontinuous to a tire hoop direction, and has adhered to the drop part 13 of the wheel W. The object 5 may adhere to the tread inner surface of the tire T, as shown in drawing 2, but in order to make mass imbalance small, it is preferred to attach to the wheel W near the axis of rotation.

[0015]As a fixing method of the object 5, it may fix with adhesives to the tire T and the wheel W, or may fix in a band to the drop part 13 of the wheel W. As shown in drawing 3, even if the tire T changes with rotation in any case, the object 5 does not contact the sidewall inner surface of the tire T in a tire-maximum-width field.

[0016]Thus, by arranging the object 5 to the closed space 4 at circumference top discontinuity, generating of the cavernous resonance phenomena in the closed space 4 can be controlled, and the noise by cavernous resonance can be reduced effectively. Since the object 5 is made non-contact to the sidewall inner surface of the tire T in the tire-maximum-width field at least, this does not become a vibration source at the time of a run.

[0017]When the object 5 built in the closed space 4 is continuously formed over the perimeter, tire weight becomes excessive and a noise reduction effect will be spoiled. Therefore, it is good to make the hoop direction length (when arranging more than one, they are those total length) of the object 5 into not less than 5% of 90% or less of peripheral length. In order to heighten a noise reduction effect further, the cross-section area in the tire meridian line section of the object 5 may be changed in the shape of a sine wave along a tire hoop direction.

[0018]The object 5 built in the closed space 4 is [0.1 or less apparent relative density / 0.05 or less] more preferably good to constitute from 0.005 or less low-specific-gravity material still more preferably. That is, since the balance weight which mass imbalance arises on a tire / wheel assembly object, and adjusts the imbalance will become excessive if the specific gravity of the component of the object 5 is large, it is not desirable. Imbalanced adjustment is easy even if it arranges the object 5 which gave volume required in order to demonstrate the noise reduction effect of the request by apparent relative density being 0.005 or less especially. Even when apparent relative density is made or less into 0.005, it is possible by covering the surface layer of the object 5 with the thin film of 1 or more MPa of elastic moduli to fully demonstrate a noise reduction effect. Foamed resin (sponge) etc. can be mentioned as above low-specific-gravity materials.

[0019]As for the cross-section area in the tire meridian line section of the object 5, it is desirable that they are 5% - 40% of the cross-section areas of the closed space 4. If a noise

reduction effect becomes it insufficient that the cross-section areas of this object 5 are less than 5% of cross-section areas of the closed space 4 and it exceeds 40% conversely, with unevenness of a road surface, etc., after tire modification has taken place too much, a built-in object object and a tire inside surface will contact, tire rigidity will increase, and tire shock buffer capacity will be reduced. Since this gives an excessive input to a vehicles suspension, it is not desirable on vehicles endurance.

[0020]The length of the tire hoop direction of the object 5 is good to make it larger than the height of a tire diameter direction. That is, it is preferred that the aspect ratio of the hoop direction length to the tire diameter direction height of the object 5 is 1.0 or more. The object 5 becomes it unstable that this aspect ratio is less than 1.0 during tire rotation, and a noise reduction effect falls. That is, a noise reduction effect is not based on the number of arrangement on the circumference of the object 5, but is based on the length of a hoop direction. Arrangement in particular of the hoop direction of the object 5 is not limited, and can make the arrangement space of a hoop direction uniformly or unequal. Although equivalent arrangement is preferred from a point of mass imbalance, the effect of expanding the frequency area of noise where unequal arrangement is reduced is expected. After mass imbalance constructs the tire T on the wheel W, it can be adjusted.

[0021]The object 5 is good in it being the foam or porosity which includes much air space. And as for the average radius of these air space, it is preferred that it is the range of 0.1 mm - 3 mm. Correlativity is between the size (average radius) of air space, and the frequency of the noise absorbed, and when it is a tire noise, an effective noise reduction effect is acquired by making the average radius of air space into a mentioned range.

[0022]As shown in drawing 5 and drawing 6, it is good for the surface of the object 5 to form the unevenness 6. Thus, if the unevenness 6 is formed in the surface of the object 5, scattered reflection of the sound wave in the closed space 4 can be carried out, and generating of cavernous resonance phenomena can be controlled more effectively. This unevenness 6 may be a zigzag configuration and corrugated form, or may be a cylindrical engraving lump hole. In particular, like drawing 5, when the unevenness 6 is formed in the end face of the tire hoop direction of the object 5, a remarkable noise reduction effect is acquired. The effect of expanding the frequency area of the noise reduced by making what changed various the radii and depth intermingled in the case of a cylindrical engraving lump hole is expected.

[0023]The object 5 built in the closed space 4 can be used as counterbalance for adjusting the mass imbalance of a tire simple substance. That is, although the tire T generally has unescapable mass imbalance, it is effectively utilizable as counterbalance by arranging the object 5 to the part which serves as mass deficiency relatively in the hoop direction of the tire T.

[0024]

[Example]Tire sizes 165/65R15 In the assembly object of the pneumatic tire of 81S, and the wheel of rim size 15x5J, the tire 1 and this invention tires 1 and 2 were manufactured, respectively conventionally which changed as following only the conditions of a closed space formed between a tire and a wheel. However, apparent relative density of the object of the low specific gravity built in a closed space was set to 0.05.

[0025]Conventional tire 1: Nothing has been arranged to a closed space formed between a tire and a wheel.

[0026]This invention tire 1: In a closed space formed between a tire and a wheel, the cross-section area in a tire meridian line section has arranged the object (refer to drawing 1) of the low specific gravity which occupies 30% of a closed space to circumference top discontinuity, and this was pasted up on the wheel drop part.

[0027]This invention tire 2: In a closed space formed between a tire and a wheel, the cross-section area in a tire meridian line section has arranged the object (refer to drawing 2) of the low specific gravity which occupies 30% of a closed space to circumference top discontinuity, and this was pasted up on the inner surface of the tire tread part.

[0028]The domestic FF vehicle with a displacement of 1.6 l. was equipped with the assembly object of these tires and a wheel, and the load noise was evaluated. As evaluation of a load noise, it ran at 40 km/h in speed in the load noise evaluation road surface, and a noise in the car was measured. Analysis is conducted by one-third octave analysis, and it is a 250-Hz level (dB). [A]It judged.

[0029]As a result, when conventionally based on the noise level of the tire 1, this invention tires 1 and 2 were all -4dB in the critical ratio.

[0030]Next, in the assembly object of the pneumatic tire of the same size as the above, and a wheel, the tire 2 and this invention tires 3 and 4 were manufactured, respectively conventionally which changed as following only the conditions of a closed space formed between a tire and a wheel. However, apparent relative density of the object of the low specific gravity built in a closed space was set to 0.05.

[0031]Conventional tire 2: To a closed space formed between a tire and a wheel, the cross-section area in a tire meridian line section has arranged continuously the object (refer to drawing 7) of the low specific gravity which occupies 30% of a closed space over the perimeter, and this was pasted up on the wheel drop part in it.

[0032]This invention tire 3: In a closed space formed between a tire and a wheel, the cross-section area in a tire meridian line section has arranged the object (refer to drawing 4) of the low specific gravity which occupies 30% of a closed space to 15% of field of peripheral length, and this was pasted up on the wheel drop part.

[0033]This invention tire 4: The object (refer to drawing 5) of the low specific gravity which the cross-section area in the tire meridian line section occupied 30% of a closed space to a closed

space formed between a tire and a wheel, and provided unevenness in it in the end face of the tire hoop direction has been arranged to 15% of field of peripheral length, and this was pasted up on the inner surface of the tire tread part.

[0034]It assembled with these tires and a wheel, the domestic FF vehicle with a displacement of 1.6 l. was equipped with the body, and the same conditions as the above estimated the load noise.

[0035]As a result, when conventionally based on the noise level of the tire 2, this invention tire 3 was -1dB in the critical ratio, and this invention tire 4 was -1.5dB in the critical ratio.

[0036]

[Effect of the Invention]So that it may become non-contact to the sidewall inner surface of a tire in a closed space formed between a tire and a wheel in a tire-maximum-width field at least according to this invention, as explained above, Since arbitrary objects are arranged to circumference top discontinuity and it fixed to either the tire and the wheel, generating of the cavernous resonance phenomena in such a closed space can be controlled, and the noise by cavernous resonance can be reduced effectively.

[Translation done.]